

MAGNETIC TAPE RECORDERS, ACCESSORIES & COMPONENTS

SHORT-FORM CATALOG

PI manufactures magnetic instrumentation tape recorders for data acquisition, processing, and reproduction; and television tape recorders for video applications. These recorders are characterized by advanced design and engineering features oriented to user needs — to make the many benefits of tape recording available in the simplest, most practical hardware.

PI recorders are in everyday use throughout the world to gather every type of data — scientific, commercial, military — that is convertible into electrical signals. You'll find PI tape recording instruments in missile data reduction centers and in medical laboratories, in flying test beds and in geophysical instrumentation vans. You'll find them used in submarine recording, research, industrial process control, and television recording. PI recorders bring to these and countless other applications the experience and capability of a company devoted exclusively to magnetic tape recording, and a record of frequent and significant advancement of tape recording state-of-the-art.

PRECISION
INSTRUMENT



Precision Magnetic Tape Recorders

Three basic types of recorders are manufactured by PI: **miniature** recorders for use in space vehicles and related applications where small size, high reliability, and light weight are the determining factors; **compact** recorders for applications which require portability and ruggedness, or which afford only limited space; and

precision laboratory recorders of advanced design. In addition, PI manufactures special purpose recording instruments and instrumentation accessories to complement the recorders shown here. Detailed information may be obtained from your local PI engineering representative, or from the PI Marketing Department.



ADVANCED LABORATORY RECORDERS

PI-400A The PI-400A is a high-performance instrumentation recorder designed for use in data acquisition and reduction centers, for the laboratory, and for general-purpose application requiring a high order of accuracy and precision. The PI-400A offers the fundamental advantages of a low inertia, high-torque drive system, and incorporates a number of refinements and advancements in technique, including crystal-controlled tape speed, electronic-servo-control of tape tension, and facility for automatic operation within a digital system. Pushbutton controls actuate logic circuits which are programmed to guide the transport from any operating mode to any other operating mode, thereby eliminating the factor of human error in control of the transport.

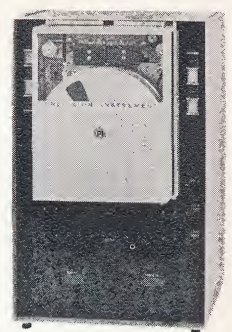
A highly practical convenience feature is total accessibility of all component units of the recorder, even during operation. For example, the entire tape transport may be rotated on vertical pivots while recording or reproducing.

Tape accommodated 1/2" or 1" tape.

Tape Speeds 1 7/8, 3 3/4, 7 1/2, 15, 30, and 60 ips, all 6 speeds electrically selectable, for recording or reproducing in both directions.

Recording Modes Direct: FM carrier; PDM; DIGITAL.

Data Bandwidth Direct: up to 250 kc at 60 ips; FM: 20 kc at 60 ips.



PORTABLE/COMPACT RECORDERS

PI-200 Series These precision-designed recorders offer performance usually associated only with laboratory instruments of much larger size and greater expense. First instrumentation recorders to utilize all-solid-state electronics, they are widely used both as fully portable field units and in rack-mounting applications in submarines, aircraft, instrumentation vans, and in data laboratories.

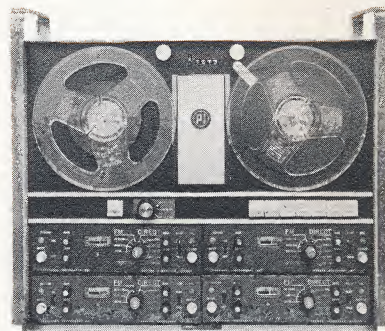
PI-200 recorders are available in 1/2" (7-channel) and 1" (14-channel) models, occupying 2 and 3 1/2 cubic feet respectively. They utilize PI's unique stacked-reel tape magazine concept which not only saves space but also permits instant interchangeability of magazines without requiring rewinding of tape. Interchangeable loop magazines are also available — see page 4.

Tape accommodated 1/4", 1/2", or 1", on standard 10 1/2" reels.

Tape speeds Either 4 or 6 standard speeds from 1 5/16 through 60 ips, in ratio of 1:2:4:8:16:32; push-button change between any 2 speeds in 1:2 ratio.

Recording Modes Direct; FM; Digital.

Data Bandwidth Direct: 200 kc at 60 ips. FM: 20 kc at 60 ips.



GENERAL PURPOSE LAB RECORDER

PI-6100 This unusually versatile recorder offers many advantages for recording such phenomena as bio-medical parameters, process variables, transients, and other analog data occurring at frequencies up to 100,000 cycles per second. A unique feature is the ability of the instrument to compress or stretch data in the ratio of 10-to-1 and 100-to-1. Thus it could be used to monitor a process from 4 o'clock pm until 8 o'clock the next morning, for example, and the entire night's operations could be played back in 9 1/2 minutes. Or, conversely, the recorder could capture the complex vibrations, pressure and temperature changes of an explosive detonation, and spread them out over several minutes for detailed analysis.

Other facets of the PI-6100's versatility are its FM/Direct front-panel-switchable electronics, its built-in calibration, single-channel through 8-channel operation on 1/4" magnetic tape, precision closed-loop transport, and speed control comparable with that of much more costly machines.

Tape Accommodated 1/4", on standard 7" reels.

Tape Speeds 37.5 ips, 3.75 ips, and .375 ips.

Recording Modes Direct and FM.

Data Bandwidth Direct: To 100 kc. FM: To 10 kc.

Power 105-230 VAC, 50-400 cps or + and -12 VDC; optional 12 VDC or 28 VDC.



LONG-TERM MONITORING RECORDER

PI-5100 For recording such variables as earthquakes, underground shockwaves, and related geophysical phenomena; and for long-term monitoring of industrial and process variables, the PI-5100 offers the ability to record for as long as 32 days without attention. It is designed to function in a variety of environments, at temperatures from 20°F. to 140°F., in relative humidities to 100%, and at altitudes up to 15,000 feet.

The PI-5100 utilizes a stacked-reel design which enables the use of 14" diameter reels and yet allows the entire recorder to be fitted into a carrying case measuring only 18½" x 15" x 10". Weight, including tape, is 35 pounds, affording easy portability. The case is sealed against moisture and can be carried in the open in any weather.

As many as 7 channels of information may be recorded simultaneously. Input requirements are 1 volt RMS into 10K ohms. Power required is 12 volts dc, with power drain of 7.5 watts maximum during operation.

Tape accommodated ½", on standard 10½" or 14" reels.

Tape speed* 15½₁₆₀ ips.

Recording Mode FM.

Data Bandwidth* DC-17 cps.

* With modification, can be as slow as 1½₈₀ ips (bandwidth of 10 cps) or as fast as 1½₁₆ ips (bandwidth of 170 cps) with recording times of 32 days and 25½ hours respectively.



INCREMENTAL RECORDER

RSL-150-7 The incremental recorder produces computer-compatible tapes from data received either synchronously or asynchronously (randomly). The recorder accepts pulses at widely varying rates and produces a standard NRZ digital tape with a uniform packing density of 200 bits per inch (556 BPI optional). When recording the output of a teletypewriter, for example, the unit eliminates the need for making an intermediate punched paper tape by converting the random pulse data into a magnetic tape format usable directly by the computer.

Upon receipt of a digital character, the RSL-150 records it and immediately advances the tape 1/200 of an inch while awaiting the next character. Resultant bit packing density is uniform whether the characters arrive 1 per month or 100 per second.

The RSL-150-7 is also available in a model with Read/Write capability.

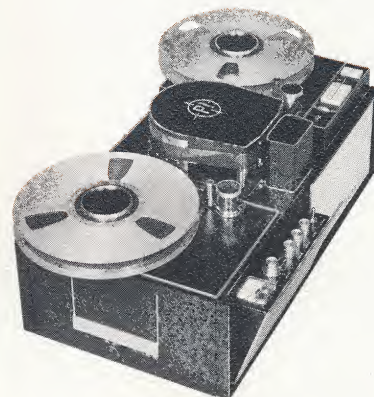
Tape accommodated ½" tape on 10½" reels.

Channels 7 tracks, including parity and clocktracks, on ½" tape.

Input requirements —12 volt pulses with 5 μsec. rise time, occurring at any rate from 0 to 100 per second.

Power 115 volts ±10%, 48 to 62 cps.

Size Uses 30 inches of standard rack space.



TELEVISION RECORDER

PI-3V For use in medical, military, industrial, and educational television applications, the PI-3V records more than 1½ hours of sight and sound on a single reel of 1" tape. Playback may be immediate, or days or years later, once or hundreds of times; and the tape may be simply erased and re-used when the recorded program material has outlived its usefulness.

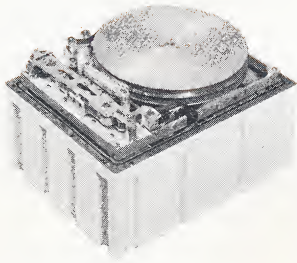
For detailed study of a portion of the televised material, the PI-3V's "Stop-Motion" feature enables the operator to "freeze" a single picture and thus observe it for several minutes. This feature is also useful in studying fast transients displayed on an oscilloscope.

Tapes recorded on one PI-3V recorder are completely interchangeable. The recorder is compatible with EIA standard or industrial sync, and operates from either vidicon or image orthicon TV cameras.

The PI-3V, because it uses 1" tape and advanced all-solid-state circuitry, is extremely compact and readily transportable (only 75 pounds) by one man. An entire TV system—including camera, monitor, and the PI-3V—can be put into the rear seat of a compact car. The PI-3V requires only 350 watts of power—plugs into any 110-volt, 50 or 60 cycle wall socket.

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ACCESSORIES & COMPONENTS



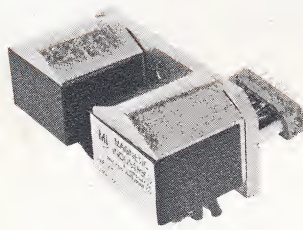
SATELLITE RECORDERS

PS-303-T First orbited in Agena satellites in the Air Force's Discoverer program, recorders of this series now have an extensive record of use in space. They offer operational characteristics that make them especially useful where there is a premium on size and weight.

PS-303-T recorders are built to the applicable sections of MIL-E-8189 specification, and are the only satellite recorders known to qualify under the environmental specifications of LMSC 6117-B.

Exceptional reliability is achieved through simplicity in design and function. For example, by recording in one direction, playing back in the other, the need for the normal rewind function is eliminated.

In operation, the recorder accepts data during more than 90% of its total time in flight. Upon receipt of a signal from the ground, it instantly goes into playback mode at many times recording speed. Record or reproduce functions can be interrupted at any time, and operation can be accomplished in either mode.



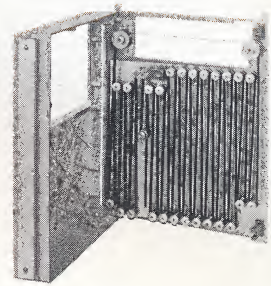
PRECISION HEADS

Precision magnetic heads for recording, playback, and erase functions are manufactured by Magnetic Industries, a subsidiary of Precision Instrument, for PI and other recorders. Standard and special headstack configurations are available; custom heads are manufactured to specifications, for analog, digital, and special-purpose recorders.

A continuing program of materials research has resulted in head designs which minimize both head wear and magnetic tape wear. High levels of performance are thus assured for significantly longer than with conventional head designs.

PRECISION FILTERS, COILS, TRANSFORMERS

MI also manufactures a variety of magnetic devices other than heads, including toroidal coils, high frequency transformers, filters, and complete networks, all made in conformance with customer specifications. In addition, MI is experienced in the design and manufacture of high-reliability solid-state converters, specialized airborne transformers, and switching, peaking, and differential transformers.

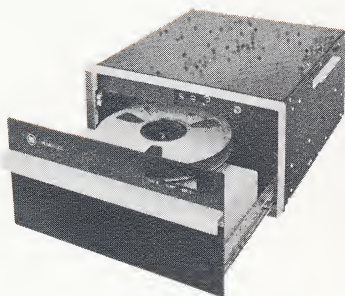


CONTINUOUS LOOP MAGAZINES

PI has designed a number of recording accessories to extend the usefulness of its basic products. The tape loop, for example, permits Series 200 recorders to be used for monitoring recording, repetitive playback, and continuous recording/reproduction. With the standard loop magazine (above) or the variable delay loop magazine, tape loops from 29 inches up to 24 feet are accommodated. Longer loops are also available in special configurations.

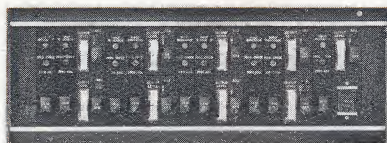
Another loop magazine is available that is designed to record data and reproduce the recorded signals after the loop has made a full circuit. An erase head — an integral part of the magazine — erases the tape after reproduction, preparing the tape to accept incoming signals continuously. Use of this magazine requires a modification in which the record and reproduce heads are reversed in position.

A Series 200 recorder may be adapted for continuous loop operation simply by attaching the loop magazine in place of the reel-to-reel magazine. No change whatever is required in the recorder itself; magazines may be interchanged at any point on the tape.



AUTOMATIC DEGAUSSER

The DG-2 Automatic Degausser will erase a full reel (7" through 14" sizes) of magnetic tape in 35 seconds. Residual signal and peak noise are at least 80 db below saturation recording level. Rack or cabinet (desk-top) mounting; approximately 1/2 cubic feet.



TELEMETRY DISCRIMINATOR

The TD-109 IRIG Subcarrier Discriminator comprises nine complete solid-state channels, with an input meter for each, in only 7" of rack space. All IRIG subcarriers, channels 1 through 18 and A through E.

PRECISION INSTRUMENT

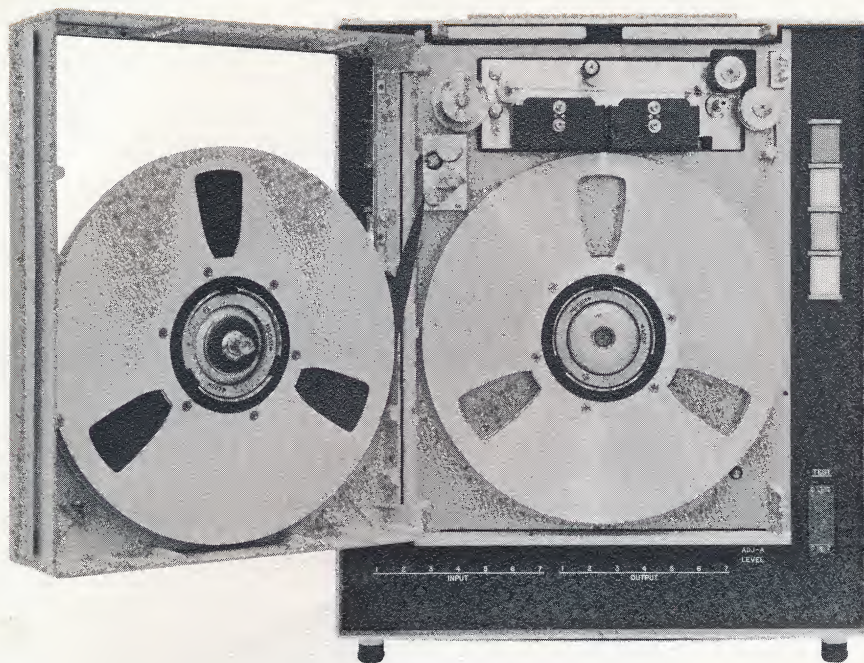


Stanford Industrial Park / Palo Alto, California



MOTOR DRIVE AMPLIFIERS

Where PI recorders are to be operated from a dc power source, or an ac power source which varies from 60 cps, a PI Motor Drive Amplifier may be used to generate a precise 60 cps. Rack or cabinet mounting.



**PI-2100
PORTABLE INSTRUMENTATION
TAPE RECORDER**

**PRECISION
INSTRUMENT**



PI-2100 — a laboratory recorder that doesn't need a laboratory

In terms of performance, the PI-2100 is in fact a laboratory recorder, comparable in all general operational parameters with larger, more complex, more costly instruments. But if you compare how and where it can be used, you'll find it the **only** laboratory recorder with the ability to adapt to non-laboratory environments. Take it with you to where the data is generated . . . down the hatch of a submarine to capture sonar signals, aboard a railroad diesel to record engine performance, or into an aircraft for airborne data acquisition . . . practically anywhere a man can go.

Not only in the field, but in research labs, medical centers, and industrial test facilities, the PI-2100's economy of size and weight give it a substantial edge over its big brothers. Because you can move it readily from one test bench to another, one room to another, or one plant to another, it can be utilized for a variety of recording jobs. While larger recorders remain idle until work can be brought to them, the PI-2100 gets more accomplished because you can bring it to the work.

And even rack-mounted in the laboratory, the PI-2100 still offers a bonus in space economy. Two 14-channel recorders, electronics included, fit nicely into the space required by a single instrumentation recorder of conventional design.

PI-2100 — conceived by engineers for engineers

When you pick up the concentric reel tape magazine and click it smartly into place; when you discover that switching the speed automatically switches the electronics; and when you inspect the clean, precision design of the transport tape drive system — you'll recognize the superior engineering skill with which the PI-2100 was conceived and put together.

It didn't happen suddenly; the basic design incorporates many of the ideas first brought to life in the PS-200 series and proved in actual use in over 1000 installations. In this earlier generation of recorders — the first all-solid-state instrumentation recorders — PI tested and proved many advances in design, some of which are still state-of-the-art in competitive instruments. But into the PI-2100 have been engineered significant new capabilities, including switchable electronics, and data accuracy and bandwidth which, up until now, you could find only in fixed laboratory recorders of greater sophistication and cost.

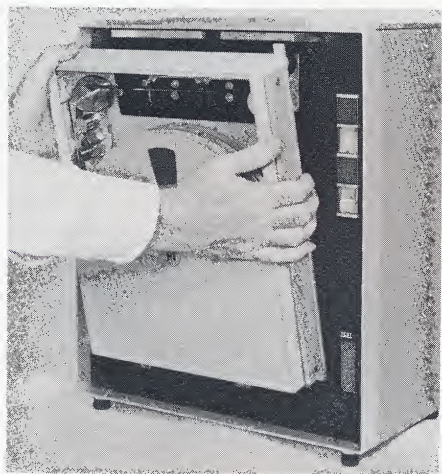
PI-2100 — the smallest recorder with all the big-recorder features

- * **300 KC FREQUENCY RESPONSE** at 60 ips, direct recording
- * **SWITCHABLE ELECTRONICS**
- * **HIGH SIGNAL/NOISE RATIOS**, 46 db at 30 and 60 ips, FM
- * **FLUTTER COMPENSATION** optional, for even greater S/N ratios
- * **HIGH TAPE SPEED ACCURACY**, constant within 0.1% throughout reel
- * **LOW FLUTTER**, less than 0.6% p-p 0.2 cps to 20 Kc at 60 ips
- * **FULL RANGE OF SPEEDS**, $15/16$ ths ips through 60 ips
- * **7 or 14 TRACK CAPABILITY — FULL IRIG COMPATABILITY**
- * **PHASE EQUALIZATION** in direct recording mode

PI-2100 — simple, rapid tape change with PI's unique stacked reel magazine

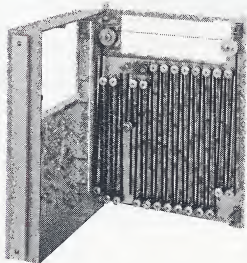


Any operator can change reels of tape in a few seconds. The tape magazine opens like a book to accept reels. Tape may be threaded from one reel to another while in this position.



The closed magazine is placed in position on a support at the bottom, and the top is swung forward until it snaps into position. This motion **automatically** threads tape over the heads, so the recorder is ready to operate at the push of a button.

A magazine may be removed at any time—with the tape fully or partially run—and replaced with another loaded magazine. It is possible to record reel after reel of data with only a few seconds interruption between reels. It is also possible to alternate between reel-to-reel and continuous-loop magazines, requiring no changes or adjustments to the recorder. Loop magazines are available as optional equipment, accommodating loops from 29 inches to 24 feet in standard models.



PI-2100—a recorder with everything it takes for 99% of all data recording assignments

ALL THE SPEEDS YOU NEED, with push-button flexibility, controllable locally or remotely.

4-speed versions

60, 30, 15, 7½ ips

6-speed versions

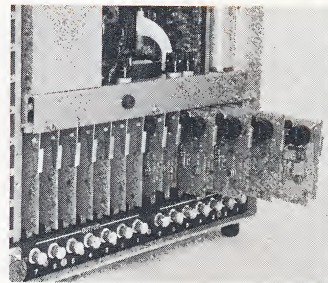
60, 30, 15, 7½, 3¾, 1⅞ ips

Other speed ranges are available.

Binary pairs of speeds (related 2:1) are instantly selectable by front-panel push-button. Other speeds are obtained through a simple belt change, made in seconds and accessible through a hinged panel at the top of the recorder.

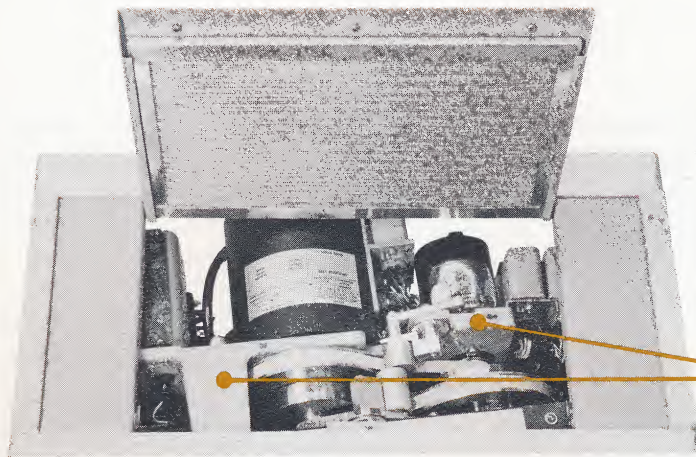
SWITCHABLE ELECTRONICS—FM AND DIRECT—ON UP TO 14 CHANNELS.

Switching recorder speeds with the front-panel pushbutton in both recording and playback modes, automatically switches the electronics. The need for costly, time-consuming recalibration or adjustment—required with most recorders—is eliminated. You can record FM or Direct data on any track interchangeable from one to the other simply by removing one electronics module and inserting another. Provides IRIG compatibility, with 4, 7, or 14 channels.



ELECTRONIC FLUTTER COMPENSATION is available as an option for even greater signal/noise ratios.

BOTH RECORDING AND PROCESSING of data can be effected with the PI-2100. Accuracy and stability of operation are such that you can prepare fully compatible IRIG tapes in the field, and use the same recorder for the data reduction; separate recorders are not required.



Rugged, single-unit casting mounts all motor and pulley units providing drive power to transport, insures freedom from flutter and vibration.

Photo-electric sensor stops tape motion when tape is absent or transparent.

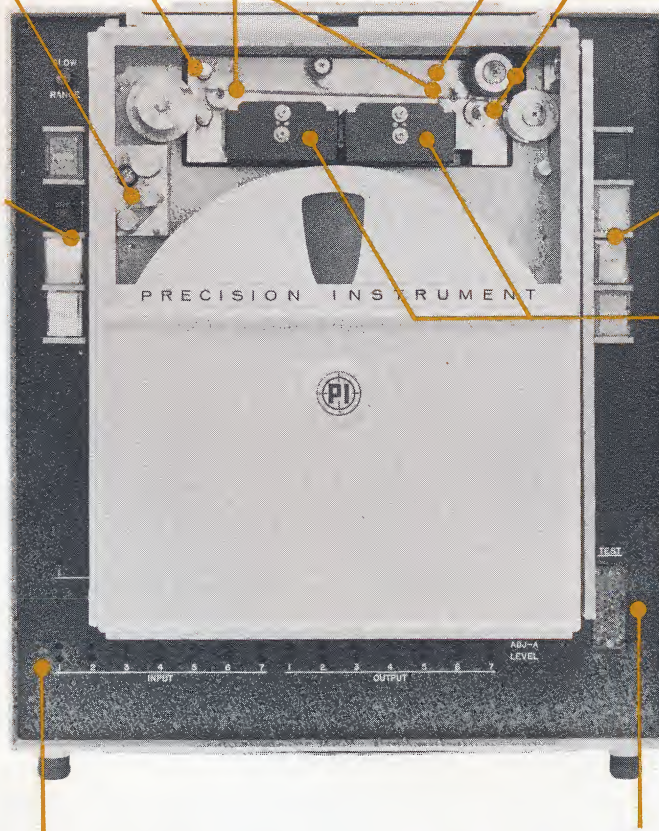
Mechanical filter — effectively decouples supply reel flutter components from head-capstan area.

Tape guides descend to position tape accurately over heads. Guides lift on FAST-FORWARD and REWIND to let tape lift from heads, thus reducing head wear and oxide accumulation.

Heavy precision mounting plate. Heads, capstan and tape guides are all mounted on this dimensionally-stable foundation to insure precise alignment.

Capstan and Pinch-roller. Both 1-mil and 1.5-mil tapes are accommodated without adjustment.

Pushbutton controls.

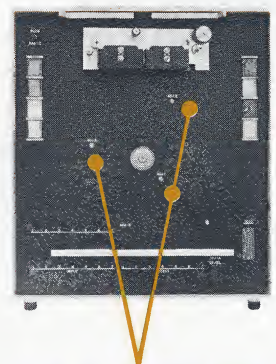


Pushbutton controls. Buttons light when depressed so that selected operating state is evident at a glance.

Record and reproduce head assemblies — interchangeable; require no adjustment when replaced.

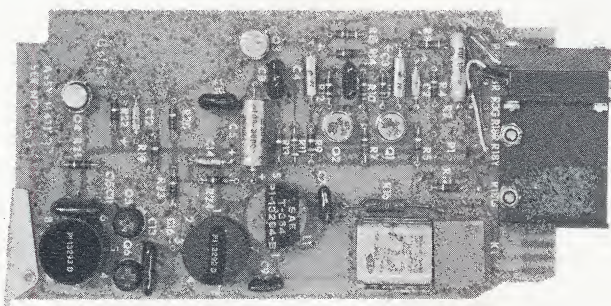
Record level, AC bias level, output level, FM center frequency and FM frequency deviation are accomplished by convenient front panel adjustments.

All significant test points (including input/output signals) are brought to the front panel for monitoring at a single test jack.



Brake and hold-back tension are simple screw driver adjustments.

PI-2100—high reliability from all-solid-state electronics Two 4" x 7" circuit cards accommodate the electronics for a complete record-reproduce channel. Seven channels of electronics occupy only one-third cubic foot of space. Circuit boards are keyed to insure proper positioning when inserted.



PI-2100 — high accuracy from precision alignment To insure dimensional stability, the PI-2100's head assemblies, tape guides, and capstan are all mounted on a single plate of stress-relieved aluminum one and one-half inches in thickness. The plate's ground and lapped surface, flat to a tolerance of 0.0005 inch per inch, mates with the precision-ground mounting surfaces of the head assemblies, which are positioned accurately by a locator pin.



PI-2100 — superior dependability in field environments from rugged construction When you plug in your data inputs and push the start button—even after a truck-trip or mule-back ride over rough terrain—you can be sure the PI-2100 is recording data. It was designed, both mechanically and electrically, for dependable operation. Sub-assemblies are structurally integrated with the compact frame, thus contributing maximum over-all strength and rigidity. The transport has been designed with conscientious avoidance of potential "bugs" and com-

plexities likely to extract a high price in down-time. Electrical circuitry has been designed with wide tolerances, manufactured to high standards and tested exhaustively before receiving the final inspection "ok."

PI-2100 — mount it to meet any field or lab requirements

RACK MOUNT. For mounting in a standard relay rack, the recorder is supplied welded into a sturdy panel 19" wide. Panel height is 21" for 7-track recorder, 28" for 14-track recorder.

SLIDE AND PIVOT MOUNT. Fitted into a standard rack with this mount, the recorder may be rolled forward on slides and rotated 180° in either direction. Thus, the entire machine becomes accessible from the front of the rack. Vertical rack space required is 22¾" for 7-track recorder, 29¾" for 14-track recorder.

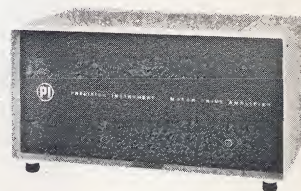
VIBRATION ISOLATION MOUNT. For use in aircraft. Dimensions for use with ½" tape recorders: H 20¾", W 19", D 13"; Dimensions for use with 1" tape recorders: H 28¾", W 19", D 15¾".



PI-2100 — power it from any source

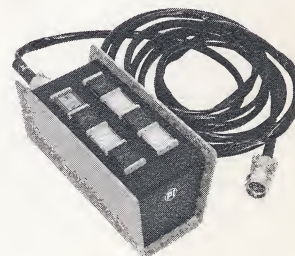
The standard PI-2100 operates from 110 volts, 60 cycles AC; it is also available in 50 cycle options. PI motor drive amplifiers permit operation from batteries, 28 volt DC supplies, or 110 volt sources of varying frequency.

The motor drive amplifier output, which provides power at 60 cycles $\pm 0.02\%$, insures highly accurate tape speed in any location.



PI-2100 — control it from any position

All operating modes—excepting On-Off—are remotely controllable through the use of a remote control box and connecting cables. Maximum distance from recorder to control position is 100 feet.




PRECISION INSTRUMENT PI recorders are at work wherever magnetic tape is used for



data acquisition, processing, and reproduction — in orbiting satellites, research laboratories, schoolrooms, submarines, and on the ocean floor. They vary widely in size as


they do in application, from the full-scale PI-400A laboratory recorder to the

100-ounce PS-303-T  used in the Agena satellite program. And in between,

the PI-6100 portable instrumentation  recorder, and the PI-200  portable/

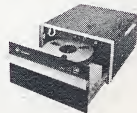

compact recorder with a unique stacked-reel design  and interchangeable loop


magazines  for repetitive recording. PI also makes the PI-3V,  lightest,

smallest portable TV recorder, and such special-purpose instruments as the PI-5100  monitoring

recorder, which can operate for as long as 32 days on a single reel, and the

unique RSL-150  which incrementally records random data in computer-ready format.

Related PI products include the DG-2 tape degausser,  TD-109  telem-

etry discriminator, and a series  of motor drive amplifiers, as well as precision

magnetic heads  manufactured by PI's subsidiary, Magnetic Industries, Inc.

All are available through a worldwide network of sales

offices and engineering representatives and distributors.



**PRECISION
INSTRUMENT**



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Bulletin 127 - 3.5M - 10/64 - Litho in U.S.A.

**PRECISION
INSTRUMENT**



TECHNICAL DATA SHEET (Preliminary)

PI-2100 Portable Instrumentation Tape Recorder



The PI-2100 is a high-performance instrument, providing operational capabilities usually associated only with laboratory machines of much larger size and greater expense. Its basic design principles were originated in the PS-200, carried forward in the PI-200, and have since been proved in use in more than a thousand installations. Significant advances in both electronic and mechanical functions have been incorporated into the PI-2100, giving it the capacity to perform highly sophisticated recording assignments in practically any laboratory or field environment.

Among the features offered in the PI-2100 are electrically-switchable electronics. In both Direct and FM modes, either recording or playback, the High/Low pushbutton on the front panel automatically switches the appropriate electronic circuitry as it changes the transport speed. No readjustments, either electrical or mechanical, are required.

Additional features provided in the PI-2100 are extended bandwidth (to 300 KC), phase compensation, and extremely low flutter resulting from improvements in mechanical design of the precision tape drive system.

The PI-2100 is one-man portable, enabling its operation in many environments which prohibit the use of conventional laboratory recorders. As a consequence, it can be widely employed in such applications as airborne data acquisition, undersea recording, and investigation of bio-physical parameters. It may also be used for general laboratory data acquisition and processing in numerous industrial, government, and educational installations throughout the world.

SPECIFICATIONS

GENERAL

Size	7-channels—18½" x 15½" x 10" deep 14-channels—26½" x 16¼" x 13¼" deep
Weight	7-channels—70 lbs. maximum with tape and electronics. 14-channels—110 lbs. maximum with tape and electronics.
Power Requirements	7-channels—300 watts maximum, 14-channels—350 watts maximum. Operates from 115V ± 10%, 60 cps AC; with accessory power converter, 115V ± 10%, 48 to 62 cps, or 24V to 28V DC with positive or negative ground.
Temperature	Operating 40°F to 120°F; Storage—60°F to +185°F.
Humidity	Up to 95% relative, non-condensing (operating).
Shock/Vibration	Shock and vibration mounts that meet MIL-C-172 are available for use in piston and jet aircraft.
Mounting	Bench-mounted; accessories available for Rack mounting (19"), Slide and pivot mounting, and Vibration-isolation mounting.

Operating Position	Vertical
Remote Control	All operating modes except on-off; 100 feet maximum.

TAPE TRANSPORT

Configuration	Concentric reel-to-reel magazine; accessory endless loop magazine available.
Reels	10½" diameter precision reels (NAB hubs); ½" for 7-channel machine, 1" for 14-channel machine.
Tape	2500 feet Nom. 1½ mil; 3600 feet 1-mil. With endless loop magazine, 29 inches to 24 feet.
Tape Speeds	4-speed version—60, 30, 15, 7½ inches per second, or 6-speed version—60, 30, 15, 7½, 3¾, 1⅞ inches per second. Other speed ranges are available.
Speed Selection	The 6-speed recorder has 3 belt positions—the 4-speed model has two belt positions. Thus any one belt position provides for 2 speeds in a 1:2 ratio, and the recorder can be electrically switched between these two speeds by means of a pushbutton on the front control panel.
Start Time	5 seconds to 60 ips—less at lower speeds.
Stop Time	2 seconds from 60 ips—less at lower speeds.

Rewind Time.....	Under 150 seconds for 2500' reel.
Speed Accuracy.....	Within 0.25% of nominal rate.
Flutter.....	Less than 0.6% peak-to-peak over bandwidth of 0.2 cps to 20 kc at 60 ips, and 0.2 cps to 10 kc at 30 ips.
Operating Modes.....	Back lighted front-panel push-buttons for POWER (On/Off), HIGH/LOW (Speed), DRIVE (Controlled Tape Motion), RECORD (Electronics energized for recording), STOP, FAST FORWARD, REWIND, and OVERRIDE.
End-of-Tape Sensing.....	End-of-tape shutoff is provided by passage of light through a clear section of tape to a photo-cell. All functions may then be made operable by depressing the OVERRIDE push-button.
Heads.....	4, 7, or 14-track head assemblies; interchangeable plug-in modules. Track widths, spacings, numbering, and tolerances conform with IRIG standards (Industry standard heads also available). Trailing edges of the record head gaps and centerlines of reproduce head gaps fall within a band 100 micro-inches wide. This band is perpendicular to head mounting base plate within ± 1 minute of arc. Stack-to-stack spacing (where applicable) is $1\frac{1}{2}" \pm 0.0005"$.

DIRECT RECORD/REPRODUCE

Input Sensitivity.....	Any input amplitude from 0.15V to 10V RMS will produce normal signal level (that which produces 1% third harmonic distortion at a frequency of 500 cps at 30 ips).
Input Impedance.....	Greater than 20,000 ohms, unbalanced to ground.

Frequency Response and S/N Ratio

Tape Speed		S/N Ratio*
60 ips.....	300 cps to 300 kc	34
30 ips.....	150 cps to 150 kc	34
15 ips.....	50 cps to 75 kc	32
7½ ips.....	50 cps to 38 kc	28
3¾ ips.....	50 cps to 19 kc	28
1½ ips.....	50 cps to 10 kc	28

* Using bandpass filter with 18 db/oct. characteristics beyond cut-off. Set to -3 db response at band edges.

Distortion.....	Total harmonic distortion, primarily 3d harmonic, at 500 cps, is less than 1.4% at tape speeds of 15 ips and above.
Output.....	At normal signal level, output amplitude is 1V RMS across 600 ohms or more. Output impedance is less than 50 ohms.
Electronics.....	Record — one card per channel for all speeds. Playback — one card per channel for all speeds with two speed plug-in equalizers, electrically switchable from the front panel.

FM RECORD/REPRODUCE

Input Sensitivity.....	Any signal amplitude from 0.6V to 10V RMS will produce full frequency deviation on tape and full-scale output signal when reproduced.
Input Impedance.....	10,000 ohms unbalanced to ground.

Frequency Response and S/N Ratio

Tape Speed	Bandwidth	S/N Ratio
60 ips.....	0-20 kc	46 db
30 ips.....	0-10 kc	46 db
15 ips.....	0-5 kc	44 db
7½ ips.....	0-2.5 kc	42 db
3¾ ips.....	0-1.25 kc	40 db
1½ ips.....	0-0.625 kc	40 db

DC Drift.....	Less than 1% of full peak-to-peak deviation over a 24-hour period following a 5-minute warm-up with line voltage varying between 105 and 125 volts and temperature varying 10°F within a range of 40° to 125°F. Less than 2% if temperature varies over full range of 40° to 125°F.
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DC Linearity.....	In a plot of input amplitude vs. reproduced amplitude, the maximum deviation from the best straight line through zero is as follows: At 1½ through 15 ips, maximum departure from linear is less than 0.5% of full peak-to-peak deviation; At 30 and 60 ips, maximum departure from linear is less than 1% of full peak-to-peak deviation.
Output.....	Full-scale output is 1V RMS into 1000 ohms. Impedance is 1000 ohms.
Electronics.....	Record — one card per channel for all speeds, with 2 speed plug-in center frequency units electrically switchable from the front panel. Auxiliary divider version is available that provides center frequencies for 6-speed operation. Playback — one card per channel for all speeds with plug-in 2-speed center frequency units, electrically switchable from the front panel.

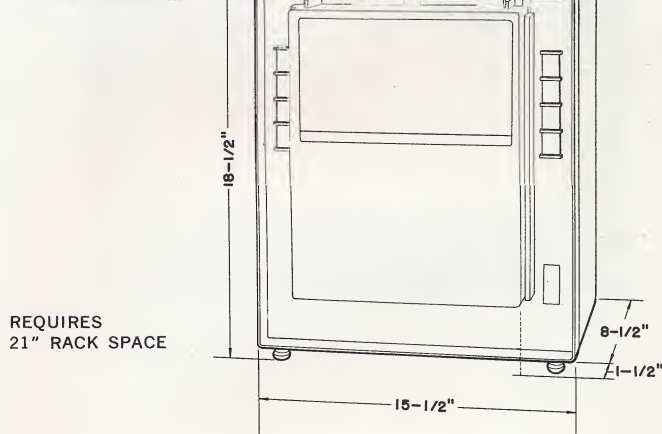
CONNECTIONS

Power.....	Push-pull miniature connectors (DEUTSCH MS) at rear.
Remote.....	Push-pull miniature connectors (DEUTSCH MS) at rear.
Signal.....	(Input and output) BNC connectors at rear.
Test.....	Female connector (WINCHESTER MRE-54S-G), front panel.

ACCESSORIES and SPECIAL OPTIONS

Motor Drive amplifiers, meter panels, remote control, special mounts (see under GENERAL), reel rotation counter, 220-volt operation, 50 cycle operation, ¼ inch magazine, loop magazine, flutter compensation.

7-TRACK RECORDER.



14-TRACK RECORDER.

